Response to Comments Document

Total Maximum Daily Load (TMDL) Development for Mossy Creek and Long Glade Run: Bacteria and General Standard (Benthic) Impairments

Introduction

A public meeting was held for the Mossy Creek and Long Glade Run TMDLs on March 2, 2004. The draft TMDL report (Total Maximum Daily Load (TMDL) Development for Mossy Creek and Long Glade Run: Bacteria and General Standard (Benthic) Impairments) was presented at the meeting and made available on the DEQ website. A public comment period on the draft report was held from March 2, 2004 until April 2, 2004. During the public comment period, three sets of comments were submitted. Each set of comments is presented below, followed by DEQ's response to each comment.

Comments Submitted by Donald Michael

Comment 1

To me, this is giving a few people a job at tax-payer expense.

Response

The goal of developing TMDLs within the state is to restore water quality, not to provide jobs. DEQ is required by federal law (Clean Water Act) and state law (Virginia Water Quality Monitoring Information and Restoration Act) to develop TMDLs for impaired water bodies. In addition, DEQ is required specifically to develop TMDLs for Mossy Creek by a judicial consent decree filed in the United States District Court for the Eastern District of Virginia.

Comment 2

As stated at the meeting, the levels that are acceptable are below the limit you are shooting for.

Response

The TMDL was developed to meet the state water quality standards. For the bacterial impairments, this standard is a geometric mean of no greater than 126 cfu/100 ml for E. coli and a maximum instantaneous E. coli limit of 235 cfu/100 ml. For the general (benthic) impairment, the criteria is, "All state waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life." These are the levels that DEQ is "shooting for" in the TMDL. The existing conditions do not meet these criteria, as demonstrated by E. coli concentrations above 235 cfu/100 ml and benthic assessments of moderate impairment. Reductions in bacteria and sediment loadings are needed to meet the bacterial and general water quality criteria.

Comment 3

Last year was a year with abundant rainfall and the year before was a drought.

Response

The TMDL was modeled to include a range of conditions, including high flow and low flow events. The TMDL was not, however, modeled to include extreme events such as the severe drought in 2002 and the record rainfall in 2003. The modeling period selected for the TMDL allocation scenarios included 1992, 1994, and 1997. These years represent below average flow, average flow, and above average flow, respectively, but do not include extreme conditions.

Comment 4

You are spending tax payer money on a wasted project.

Response

As described above, DEQ is required by federal law (Clean Water Act) and state law (Virginia Water Quality Monitoring Information and Restoration Act) to develop TMDLs for impaired water bodies. In addition, DEQ is required specifically to develop TMDLs for Mossy Creek by a judicial consent decree filed in the United States District Court for the Eastern District of Virginia. DEQ believes that the TMDL development and implementation process can lead to the improvement and restoration of Virginia's water quality. As an example, significant reductions in the monitored levels of bacteria in Muddy Creek have been observed since TMDL implementation began in 1999-2000. Muddy Creek was one of the first watersheds in the state to undergo TMDL development and the first phase of implementation.

Comments Submitted by Wil Orndorff

Comment 1

When I initially read the Mossy Creek TMDL, I was disappointed to see the lack of acknowledgement of the fact that the majority of the drainage basin for Mossy Creek lies outside the Mossy Creek surface drainage basin as delineated on topographic maps.

I assisted Virginia Tech BSE personnel in demonstrating conclusively that the base flow of the stream comes from a group of springs that include recharge areas outside of the surface watershed. In particular, the spring at the headwaters of Mossy Creek at Mt. Solon derives its flow from the North River and from Freemason Run, both entirely outside of the Mossy Creek surface watershed. Indeed, during drought the entire flow of both Freemasons Run and North River are pirated by cave systems to the headwaters of Mossy Creek at Mt. Solon. The graphic below illustrates these relationships. This was demonstrated by tracer dye studies performed by DCR Karst Program staff at program expense. Furthermore, at least three other springs contribute significant volumes of water to Mossy Creek from outside the topographically defined watershed.

While concentrations in autosamplers suggested significant dilution of the North River trace, there were no such samples taken for the Freemason Run injection. Concentrations in solutions eluted via standard methods from activated charcoal were approximately 30 times greater for the Freemason Run injection, suggesting relatively little dilution of water from Freemason Run that emerges at Mt. Solon spring. This suggests that land use activities in Freemason Run watershed could have a direct and rapid effect on water quality in Mossy Creek.

I had not commented earlier on this because I believed that the technical assistance I provided the Virginia Tech BSE personnel would have prevented these omissions. The springs, critical

to understanding the hydrology of Mossy Creek, are only mentioned twice in the report (page 119 and 173). Yet they are the only source of water in the basin during times of extreme drought. In order for any model of the watershed to be connected to reality in a meaningful way, it has to address the intrabasin transfer of water accomplished by karst systems.

Development of a TMDL implementation based on the draft report could fail miserably at addressing the sources of impairment. Certainly, adoption of best management practices within the Mossy Creek watershed proper will improve conditions, but if such practices are not also installed in the pirated, adjacent watersheds, it may not be enough to eliminate the impairments.

Subsequent to my email of 22 March 2004, staff of the Biological Systems Engineering Department have contacted me and are revising the report to include information on karst. Data on bacterial concentrations at the springs suggests that, although fecal coliform were present in low numbers, their concentrations were significantly lower than those found downstream, suggesting that the spring water has a positive, dilutant effect. Sedimentation from the springs appears to be significant only during storm events, and mostly at the Mt. Solon Spring. Fortunately, the large impoundment (pond) downstream of the spring serves to capture the majority of that sediment, minimizing its impact to the watershed.

The Freemason Run Watershed and the portion of the North River Watershed between Mossy Creek and North River should still be included as areas for BMP installation during the implementation phase, as they recommend areas of high pollution potential relative to the karst springs that supply the base flow to Mossy Creek.

Response

Flows from springs that connect Mossy Creek to drainage areas outside of the topographic watershed were included in the Mossy Creek TMDL model, however, this inclusion was not described in the draft TMDL report. The TMDL report has been revised to describe these features in the model. Flow from four springs were included: Mount Solon Spring, Blue Hole, Cress Pond, and Kyle's Mill Spring. Because dye tracer studies demonstrated the linkage between North River and Mount Solon Springs, the Mount Solon Spring flow was modeled as a function of the North River flow. This function was determined as 0.02 x North River flow. The 0.02 value represents the ratio of the maximum Mount Solon Spring flow to the maximum North River flow during the same period. This value was also used as a calibration parameter in the model, and 0.02 represented the best calibration fit. The remaining springs, which were less variable than Mount Solon Spring and which did not have as well defined extra-basin connections, were modeled as constant flows at the mean discharge rate (Table 1).

Table 1. Discharge Rates of Springs in Mossy Creek

Spring	*Approximate discharge rate (cfs)*	*Discharge rate used for modeling (cfs)*
Mount Solon Spring	*3-7*	*0.02 * North River Flow Rate*
Blue Hole	*1-3*	*2*
Cress Pond	*5-7*	*6*
Kyle's Mill Series	*2-3*	*2.5*

The flow conditions represented in the TMDL model adequately account for spring flows and documented connections to extra-basin flows. The flow conditions represented in the TMDL

model also adequately reflect observed in-stream flows in Mossy Creek. The model was calibrated to best match modeled flows to observed flows. Following calibration, all calibration evaluation criteria, including total volume, 50% lowest flows, 10% highest flows, storm peaks, seasonal volume error, and summer storm volume error, were easily met within established guidelines.

Bacteria contributions from these four springs were not included in the original TMDL model, however, the model was revised as a result of these comments to consider bacteria contributions from the springs. Detailed information about the fate and transport of bacteria from extra-basin sources through the karst network and to Mossy Creek springs is not available for modeling spring bacteria concentrations as a function of landuse patterns and bacterial loadings outside of the topographic watershed. As an alternative, bacteria loads coming from the springs were modeled as a point source of bacteria at each spring. The concentration of bacteria coming from the springs was modeled as a constant based on the geometric mean of measured bacteria concentrations in each spring (Table 2).

Table 2. Observed Fecal Coliform Concentrations in Spring Flows to Mossy Creek.

	Mt. Solon Spring	*Blue Hole Spring*	*Kyle's Mill Spring*	*Cress Pond*
Date	*Fecal Coliform, cfu/100 mL or MPN/100 mL*			
8/16/2002	*10*	*120*	*<10*	*--*
9/18/2002	*<20*	*20*	*--*	*20*
10/2/2002	*40*	*--*	*--*	*110*
11/21/2002	*130*	*300*	*40*	*230*
3/12/2003	*80*	*20*	*<20*	*--*
4/30/2003	*70*	*110*	*<20*	*--*
5/20/2003	*230*	*800*	*<20*	*--*
Geometric Mean	*54*	*104*	*20*[a]	*80*

[a]*because of the low values for Kyle's Mill Spring, the concentration typically assigned to groundwater, 20 cfu/100 mL, was used.*

The revised TMDL model that incorporates bacterial loads from the springs showed that bacterial controls within the topographic watershed would be able to meet the water quality standard without controls in areas outside of the topographic watershed. Contributions from these areas, however, will not be ignored. TMDL development is underway in the North River and North River tributaries, including Freemason Run, so implementation of bacteria controls within the larger Mossy Creek hydrologic watershed will be realized as a result of those TMDLs. Implementation of bacteria controls within these contributing watersheds will speed the implementation process in Mossy Creek and add to the reductions achieved within the Mossy Creek watershed. The implementation section of the Mossy Creek TMDL report was revised to discuss this connection between adjoining watersheds and the interaction of bacterial controls implemented among the watersheds.

Comment 2

It is important to note that Mossy Creek is not unique in its karst nature, and that unless DEQ or its agents are able to perform water quality and quantity assessments of springs, and subsequent recharge area delineations of major karst springs feeding impaired streams, many of the TMDL reports for streams in karst regions will be of reduced value. DCR karst program staff is happy to assist DEQ in identifying watersheds on the TMDL list where karst could be an issue, and also helping DEQ develop a methodologically sound approach to solving this problem. This problem extends beyond the boundaries of our state, and Virginia

could play a lead role in determining how these complex karst systems can fit into the TMDL process.

Response

DEQ agrees that the karst issue is not unique to Mossy Creek, but is a prevalent factor in many of the state's streams. DEQ is committed to incorporating karst features into TMDL development when they contribute significantly to the flow regime and pollutant load. DEQ is also interested in pursuing discussions and collaboration with DCR's Karst Program to investigate approaches to addressing karst issues in future TMDLs.

Comments Submitted by Josh Rubinstein

Comment 1

In the draft TMDL report for Mossy Creek, DEQ and DCR have made the assumption that the source area for the creek is contained within the creek's topographic basin. There is no evidence on which to make that assumption. In fact there is evidence that most of the flow in Mossy Creek comes from outside of this "watershed" and feeds the main karst spring at the head waters of the creek. Said Mostaghimi and Jeff Wyn from the Watershed Assessment Laboratory at Virginia Polytechnic Institute compared the precipitation within to the runoff from the topographic basins for Long Glade Creek and Mossy Creek for each year from 1998 to 2001. In Long Glade Creek, as in most watersheds, runoff accounted for 20% or less of the rainfall. In Mossy Creek, the ratio of runoff to rainfall ranged from almost .4 in 2000 to greater than 1.6 in 1998. If every rain drop that fell in Mossy Creek's topographic basin in 1998 made it into the creek, more than a third of Mossy Creek's flow would still be unaccounted for.

In your lengthy draft TMDL report for Mossy Creek, you have asked for drastic reductions in both sedimentation and bacterial loading by those who live within the topographic basin. With the source area for the greater portion of Mossy Creeks unaccounted for in the draft, it is likely that even if those reductions are made they will be ineffective. As a professional whose work is source water protection, I can say it does more harm to future efforts to have an ineffective plan than no plan at all.

The underestimation of the source area for waters in karst terrain is systemic in the state planning efforts. I find it disturbing that policy is wed to the convenience of defining the "watershed" by the topographic basin even where there is ample evidence to the contrary.

Response

See response to comment #1 submitted by Wil Orndorff.